

RESEARCH ARTICLE



Species Diversity across Fish Markets in Andhra Pradesh and Telengana

Shyam S Salim^{1*}, Lowrane Stanley¹, N R Athira¹, K Lakshmanadinesh¹

¹ SEETTD, ICAR - Central Marine Fisheries Research Institute, Kochi, 682 018, Kerala, India

 OPEN ACCESS

Received: 04.01.2021

Accepted: 14.03.2021

Published: 19.04.2021

Citation: Shyam S Salim , Stanley L, Athira NR, Lakshmanadinesh K (2021) Species Diversity across Fish Markets in Andhra Pradesh and Telengana. Indian Journal of Economics and Development, Vol. 9, Article ID: IJED-2021-4, Pages: 9. Doi: <https://doi.org/10.17485/IJED/v9.2021.4>

* **Corresponding author.**

shyam.icar@gmail.com

Funding: None

Competing Interests: None

Copyright: © 2021 Shyam S Salim et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published By Indian Society for Education and Environment ([iSee](https://www.isee.in/))

ISSN

Print: 2320-9828

Electronic: 2320-9836

Abstract

Objectives: To assess the species and market diversity across the major fish markets of Andhra Pradesh and Telengana in India. **Methods/Statistical analysis:** The primary statistical tool of percentage analysis, diversity index and constraint analysis has been carried out to assess various parameters of the study. One of the major analysis employed diversity index method to assess the diversification of fish markets which indicates the number of species available/traded in a particular market as well as species diversity which indicates the spatial distribution of a particular species across markets and Spearman Rank Correlation Coefficient method is carried out to deduce the constraints in fish trade by the traders across the major fish markets of Andhra Pradesh and Telengana. **Findings/Application:** The study points out that the total species traded across different fish markets of Andhra Pradesh and Telengana, inland species (Catla, Rohu, Tilapia, *Pangasius*) are the most available and traded fishes compared to other fishes traded/available across the markets. Markets had been the major drivers for the fisheries production system channeling the fish landed/produced in realizing the value. Thus, the price and demand of a fish is influenced by market structure, seasonal abundance, and origin of species, size and quality. Fish demand was sensitive to the price changes, the inland fishes were the highly preferred fish species among consumers in Andhra Pradesh and Telengana and its demand seemed to be low-responsive to price changes, keeping the income constant. The study also analysed the major constraints perceived by the different traders operating in Telengana and Andhra Pradesh using the Spearman's rank correlation method. The constraint analysis indicates that low quantum of fish and lower product diversity contributed as the major constraint to the traders both on Telengana (0.89) and Andhra Pradesh (0.84) fish markets. This was primarily characterised due to low amount of fish arrivals and disbursal within the market. The traders had constraints related to inadequate infrastructure and amenities leading to non-imparting of value additions, limited facilities of ice, cold, storage, parking, inappropriate market locations, hygiene measures were improper and poor handling measures were found to be the some of the major constraints affecting the particular markets. Moreover, development of a Fish Market Price Information system could act as a support system for ensuring the fish

price movements across the state and could provide virtual price information, fish accessibility, affordability and availability of fish for the people enabling domestic fish marketing policies for future.

Keywords: Diversity Index; Species Diversity; Market Diversity

1 Introduction

Fisheries sector which contributes to national economy of the country has witnessed a phenomenal growth during the last few decades^(1,2). It is a direct source of livelihoods for more than 20 million fishers and a fish farmer, which contributes 1.75 trillion annually to the gross value added to India's economy and is a major export earner, with fish being one of the most important agricultural commodities to be exported from India⁽³⁾. Thus, fisheries sector is booming and contributing increasingly to the economic growth of the nation⁽⁴⁾. The country stands third in the world in total fish production and second in inland aquaculture. On one side fish continues to be a poor man's protein ensuring food security and on other side it offers a delicacy of huge prices⁽⁵⁾. It has been identified that about 60 percent of the Indian populace consume fish and consumption patterns varies spatio-temporally across the different social fabric⁽⁶⁾. Demand for fish is increasing because of awareness levels of the people on importance of fish consumption in the upkeep of for health⁽⁶⁾. Growth of fish production and development of fisheries sector depends largely on an efficient marketing system. Climate changes pose a serious threat to fish availability⁽⁷⁾. Increase or decrease in demand of any product depends on its utility reflected on consumer's preference and their income level⁽⁸⁾. Naturally, the price and demand of a fish is influenced by market structure, seasonal abundance, and origin of species, size and quality⁽⁹⁾.

India has very rich diversity in the marine fisheries resources with more than 1000 species reported in the landings. The total marine fish landings from the mainland of India in the year 2019 was 3.56 million tonnes compared to 3.49 million tonnes in 2018, showing a marginal increase of about 73,770 tonnes (2.1%). The landing records in 2019 indicated Tamil Nadu as the major contributor with 7.75 lakh tonnes followed by Gujarat (7.49), Kerala (5.44), Karnataka (5.01) and Andhra Pradesh (2.59). The states such as West Bengal (55%), Andhra Pradesh (34%), Odisha (14.5%), Karnataka (11%) and Tamil Nadu (10.4%) recorded increase in the landings, the marine fish catch decreased in Maharashtra (32%), Goa (44%) and Kerala (15.4%)⁽¹⁰⁾.

The state of Andhra Pradesh has the third longest coastline in India with a length of about 975 km, with 555 marine fishing villages situated along the coast of Andhra Pradesh with 349 fish landing centres as per CMFRI census, 2010⁽¹¹⁾. It is one of the important fish producing coastal states in the country. It ranks fifth in the contribution to the marine fish landings of the country. The fishery is contributed by mechanized, motorized and traditional sectors. Hence, there is a perceptible increase in the landings of the demersal fishes, as well as crustacean and molluscan resources. The value of marine fish landings during 2019 at landing centre level was 3341 crores and retail centre level was 5480 crores. (CMFRI Annual report 2019). The state of Telengana has the third largest inland water resource base in India for fisheries with 27.14 lakh population comprising of fishermen communities. Telengana is important with reference to fisheries with highest fish and seed production and also relatively higher number of aquaculture farms.

2 Materials and Methods

The study was based on the primary data collected from the 21 fish markets of Andhra Pradesh and 7 fish markets of Telengana including landing centres, retail and wholesale markets during the period of August 2019- March 2020. The data were collected through regular and systematic weekly (twice or thrice) price primary surveys conducted as a part of the study. As a part of the study, a spatio – temporal price series analysis was done across and within the selected markets.

In order to analyse the data, the fish prices were sorted weekly accordingly as four prices set in a month wise, prices of different species in 1 to 7 (first week), 8 to 14 (second week), 15 to 22 (third week), 22 to 30 (fourth week) and are arranged with respect to size differential viz., small, medium and large size of the species of the respective markets. The price details of around 25 species of Telengana and 22 species of Andhra Pradesh which are commercially traded fish species is collected on a weekly basis through a structured schedule called Market Price (MAP) have been developed for the study.

For better clarity of analysis the selected species were again classified into two — marine and inland with respective sizes across the different markets. The average prices and price behavior of each species (small, medium and large sizes) were identified respectively in the different fish markets across the time period. The max-min prices of the respective markets were also estimated with respect to the different sizes of the species to understand the efficiency of the selected fish markets across the time period. [Figures 1 and 2] represents the identified markets on the Andhra Pradesh and Telengana . The maps were plotted using ArcGIS Pro software.

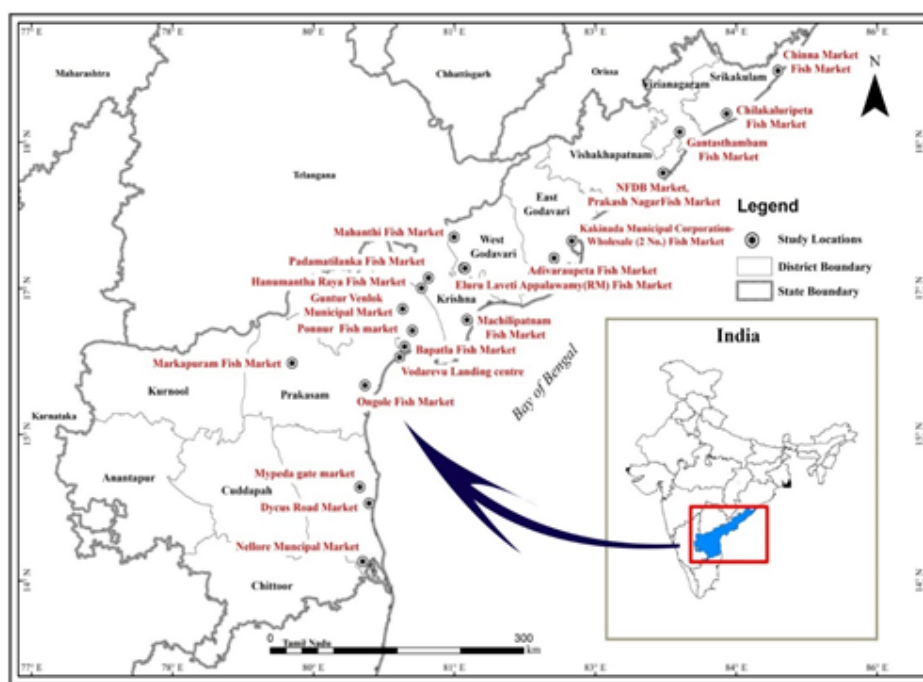


Fig 1. Locale of the study-Andhra Pradesh

2.1 Analytical tools

Different statistical and econometric tools such as diversity index, percentage analysis, etc. were deployed for analysing the data.

2.1.1 S.M.P-Species-Market Price analytics

The diversification of market as well as species with respect to the periods have been measured using the Simpson Index of Diversity (S.I.D). The index ranges between 0-1, tend towards zero when there is specialization and towards one when there is

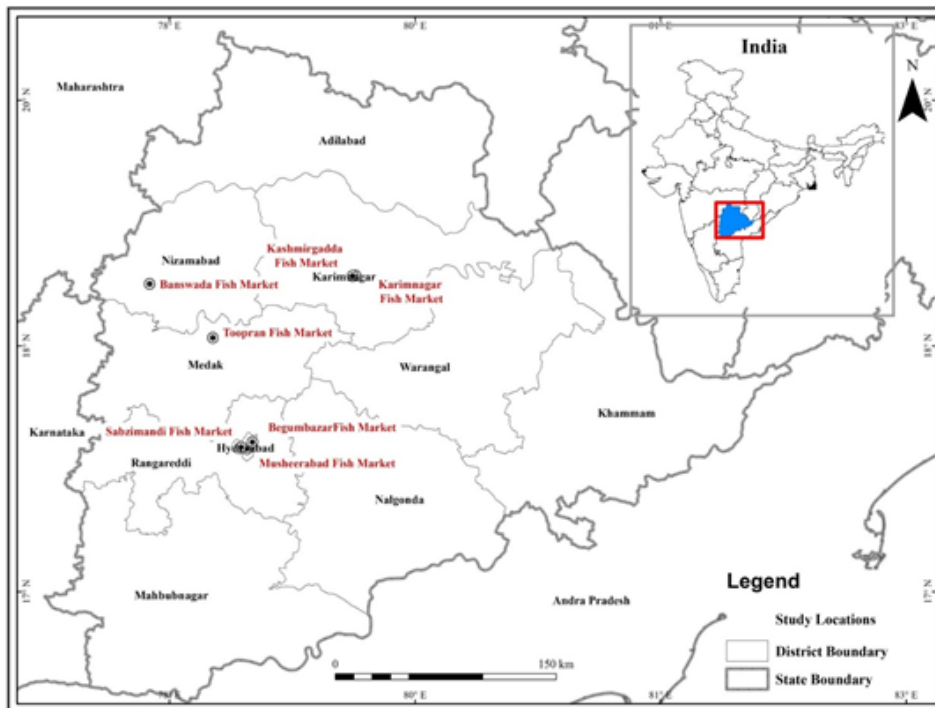


Fig 2. Locale of the study- Telengana

complete diversification. The Simpson Index of Diversity is calculated using the following equation:

$$SID = 1 - \sum_{i=1}^n W_i^2 \quad \text{and} \quad W_i = \frac{X_i}{\sum_{i=1}^n X_i}$$

Where X_i = Value of i^{th} commodity

W_i = Proportionate value of i^{th} commodity out of total quantity

2.1.2 Constraint analysis

The constraints in fish trade opined by the traders were analysed using the Spearman Rank Correlation Coefficient method. The Spearman's rank coefficient of correlation is a non-parametric measure of rank correlation which measures the strength and direction of the association between the ranked variables. The formula for Spearman's rank coefficient is:

$$\rho = 1 - \frac{6\sum_i d_i^2}{n(n^2 - 1)}$$

Where,

n = number of data points of the two variables

d_i = difference in ranks of the " i_{th} " element

3 Results and Discussion

The collected data were analysed and the results were discussed under the following heads.

3.1 Species and Market diversity analysis

The study assessed that around 25 species were traded in the selected markets of Telengana and 22 species from Andhra Pradesh. The most common species traded were Catla, Rohu, Tilapia, Anchovies and Silver pomfret. Price differentiation exists for the different fish species. The extent of diversification was quantified for both species wise and market wise using species/market

diversity index. The diversity assessment was derived based on the species availability across and within markets. Accordingly, market diversity indicates that the number of species available/ traded in a particular market and it ranges from 0 to 1. Similarly, the species diversity indicates the spatial distribution of a particular species across markets, and it ranges from 0 to 1. More market diversity index indicates more species traded within a market and similarly more species diversity index indicates the spatial spread of a particular species across markets.

The market diversity assessment results indicates that the average market diversity index of Andhra Pradesh was found to be 0.65 which means that of the 22 species traded 65 percent of them are available in the different markets of Andhra Pradesh. Of the 21 markets selected it was found that the among the identified markets Vodarevu Landing centre and Dycus Road Market has the highest diversity of 0.90 which indicated that among the 22 species traded 90 percent are available and accessible in Vodarevu Landing centre and Dycus Road Market [Figure 3].

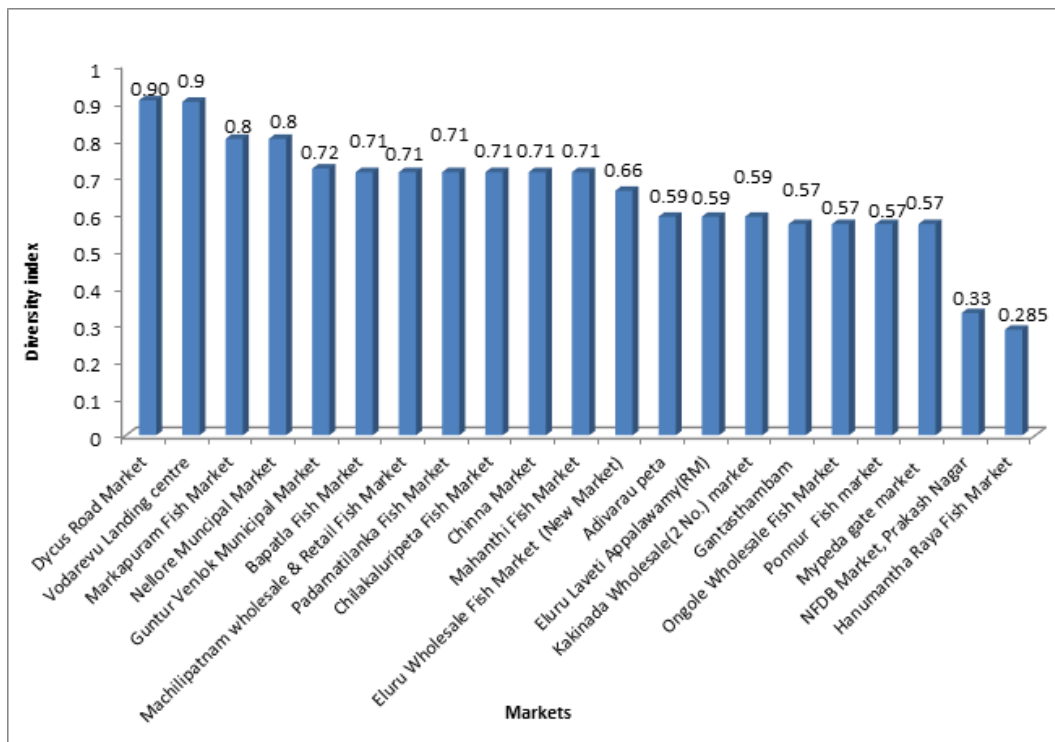


Fig 3. Market diversity-Andhra Pradesh

Similarly, market diversity assesses results indicates that the average market diversity index of Telengana was found to be 0.50 which means that of the 25 species traded 50 percent of them are available in the different markets of Telengana. Of the 7 markets selected it was found that among the identified markets Begumbazar fish market has the highest diversity of 0.68 which indicated that among the 25 species traded 68 percent are available and accessible in Begumbazar fish market [Figure 4].

The species diversity comprises of species richness (number of species in a defined area), species abundance (relative number of species). The average species diversity of the different markets of Andhra Pradesh was found to be 0.62. Of the 22 species traded across the different markets it was found that the among the identified species Catla has the highest diversity of 0.956 and Rohu is the second most with diversity index 0.913 followed by Silver pomfret (0.913) and Anchovies (0.91) which indicated that among the 21 markets selected Catla was traded in 95 per cent of the markets, Rohu 91 percent, Silver pomfret 91 percent and Anchovies 91 percent making these four as the most available and accessible fish across the markets. All the markets found Catla, Rohu, Silver pomfret and Anchovies are the species which has huge trading opportunities [Figure 5].

The average species diversity of the different markets of Telengana was found to be 0.5. Of the 25 species traded across the different markets it was found that the among the identified species Catla, Rohu, Tilapia and *Pangasius* has the highest diversity of 1.0 which indicated that among the 7 markets selected Catla, Rohu, Tilapia and *Pangasius* are the most available and accessible and traded fish across the markets. Mugaonkar et al⁽¹²⁾ examined the Delineation of Supply chain of *Pangasius* in India-A case of Andhra Pradesh. The study found that the *Pangasius* was mainly produced and supplied from state of Andhra

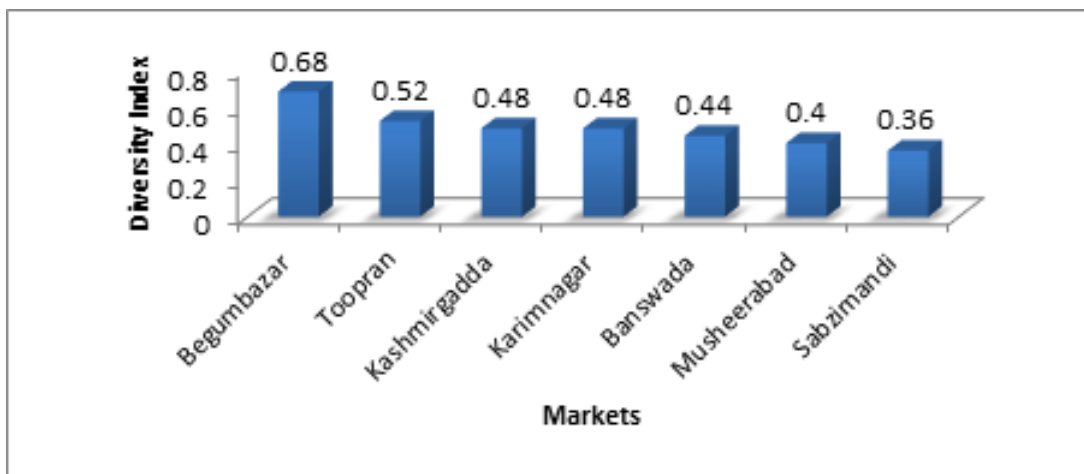


Fig 4. Market diversity- Telengana

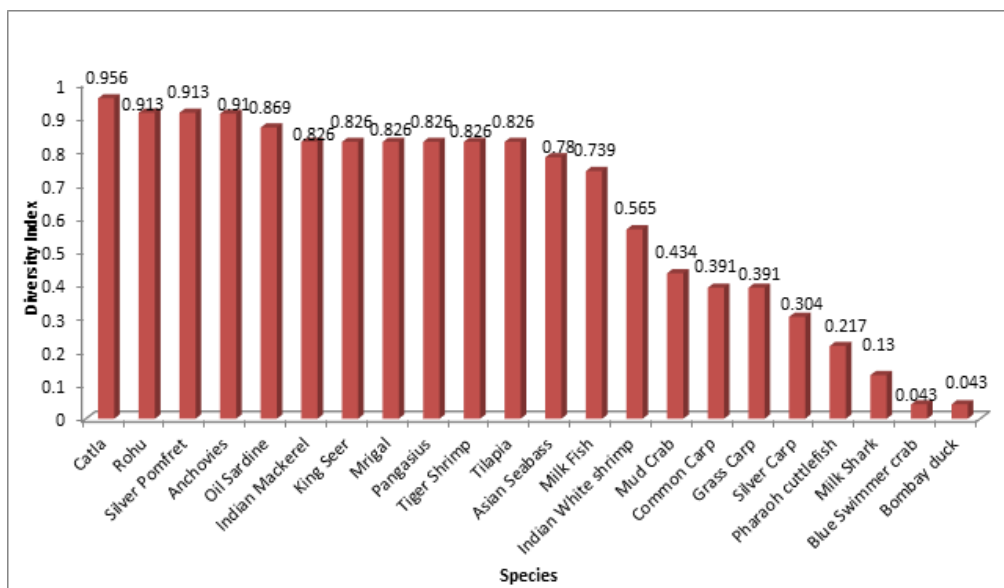


Fig 5. Species diversity- Andhra Pradesh

Pradesh to several states in India. Farmers opined that negligible local demand compelled farmers to sell *Pangasius* in distant market. Promotion of *Pangasius* consumption in home state and nearby states will go a long way in improving local demand and to ensure better prices. This may realise sustainable development of *Pangasius* in India [Figure 6].

Finfishes and crustaceans were the major groups contributing to the fishery of this region. Molluscs and other groups formed a negligible part of the catch.⁽¹³⁾ Among the fin fishes, the Catla, Rohu, Tilapia, *Pangasius*, Silver pomfret and Anchovies were the major fishes traded /available and are commercially important and fetch a good price both in local as well as markets outside the state.

3.2 Constraint analysis in Trade

The major constraints perceived by the different traders operating in Telengana and Andhra Pradesh were assessed on an 11 point continuum using the Spearman's rank correlation method. The constraint analysis indicates that low quantum of fish and lower product diversity contributed as the major constraint to the traders both on Telengana (0.89) and Andhra Pradesh (0.84) fish markets. This was primarily characterised due to low amount of fish arrivals and disbursal within the market. The

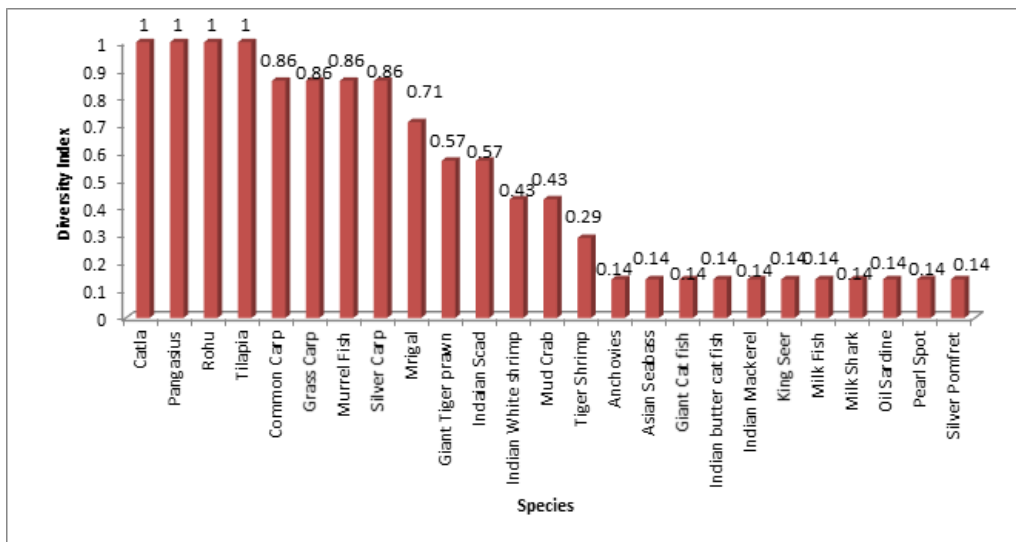


Fig 6. Species diversity- Telengana

number of fish traded in the markets was found to be 25 species in Telengana and 22 species in Andhra Pradesh. The average trade happening in the particular market was less than 500 - 600 Kg on an average in these markets. The trades had constraints related to inadequate infrastructure and amenities leading to non-imparting of value additions, limited facilities of ice, cold, storage, parking etc., In⁽¹⁴⁾ has made an evaluation on domestic marketing of fish in India. The study shows that the marketing efficiency has been found more in the case of marine species than freshwater species, since the latter travel longer distances from the point of production to consumption centre, passing many intermediaries as compared to the former.

Most of these markets across Telengana and Andhra Pradesh were of small size thereby the traders were unable to provide for many other additional infrastructure and amenities which appears to be the most important factor and interventions are required from the Government on the same. In⁽¹⁵⁾ examined the market arrivals and disposals of the markets of North Coastal districts of Andhra Pradesh. The study established that the north coastal districts of Andhra Pradesh are one of the major zones where fish markets and the trading operations are widely distributed covering the different parts of the state and other distribution and consumption destinations. Among these markets lack of appropriate infrastructure and adequate amenities and low product diversity act as limiting factors in fish trade in majority of the markets. Hence, appropriate government interventions in terms of strengthening infrastructure and imparting value addition may be created to facilitate better functioning of these markets, thereby augmenting revenue and catering to the increased demand for marine fish from nearby states.

The markets across Telengana and Andhra Pradesh exists cut worth competitions among traders leading to differential prices throughout the day. The limited arrivals and inability to process value additions, all results in cut worth competition in most of the times the fishes were sold at a par price leading to lower income⁽¹⁶⁾. In⁽¹⁷⁾ studied the marketing structure, marketing channels, producer's share, marketing margins and marketing efficiency in the selected fish markets of Tripura. The result of the study revealed that the marketing efficiency is higher for fish produced locally than for fish brought in from other states. The fisher's share in consumer's rupee varies across different marketing channels and is more for fish produced and sold locally and also identified the constraints being faced by the fishers in marketing and has suggested some measures for easy operation and regulation of fish marketing in Tripura.

There exists unawareness among the marketing functions across Telengana and Andhra Pradesh including traders and consumers this resulted in low inflow of consumers in this particular area where they were not catering to high level of retail competitions. The transaction costs of transport were found to be a less concern among the traders in these markets. In⁽¹⁸⁾ examined the fish transportation and marketing in Shahabad special reference to Dumraon and Buxar, South Bihar, India. The study could identify that the infrastructure facilities of fish market; present fish market structure and the factor influence the fish marketing system of Dumraon and Buxar and concluded that chain of fish market from producer to retailers goes onward through a number of intermediaries, fish market structure, species, quality; size and weight of fish have an influence on the price of fish.

Most of the markets in Telengana and Andhra Pradesh were constructed away from the city catering to the spatial requirement but eventually they were unable to create lot of demand among the consumers in around the locality. The markets operating were not exclusively related to fish alone but had been given a small portion of the market towards other protein components like meat, egg etc. The value addition facilities were limited in the market leading to the distress sale in the night and also inability to store fish for the next day. In⁽¹⁹⁾ studied the Value Chain Management Practices of Fresh Fish of Coastal Andhra Pradesh. The study points out the cost of value addition processes being performed by fishermen in Coastal area of Andhra Pradesh state and proposes to concentrate on the processes which are of value added and not to concentrate on the processes which are of non-value added. Value Chain Management in fisheries will help the fishermen in offering great value with minimum cost.

Moreover, the study identified that the hygiene measures were improper and poor handling measures were found to be the some of the major constraints affecting the particular markets. In⁽²⁰⁾ studied the Quality of dry fish from markets in Andhra Pradesh. The present study was carried out to analyse the quality of dry fish using biochemical and bacteriological evaluation. The result of the study revealed that most of the market samples had high moisture and sand contents and poor quality of the finished product. The infrastructure facilities at most of the surveyed landing centres, fishing harbours and wholesale and retail markets have been found grossly inadequate and poorly maintained. The study has highlighted the need for formulating a uniform market policy for fishes for easy operation and regulation so that the country's fish production is efficiently managed and delivered to the consuming population, ensuring at the same time remunerative prices to the fishers. It was also found that inappropriate market locations was a major determinantal factor in improving the fish marketing and revenue. [Table 1].

Table 1. Major Constraints in trade

Sl. No	Constraints	Telengana		Andhra Pradesh	
		Score	Rank	Score	Rank
1.	Low quantum of fish and product diversity	0.89	I	0.84	I
2.	Limited operational time	0.55	VI	0.63	IV
3.	Inadequate infrastructure and amenities	0.75	II	0.73	II
4.	Non-specialization of fish markets	0.51	VII	0.61	V
5.	Cut-throat competition among traders	0.62	III	0.59	VI
6.	Poor value addition leading to lower shelf life	0.45	IX	0.46	VIII
7.	High transaction costs	0.36	XI	0.33	XI
8.	Improper hygiene and Poor handling measures	0.48	VIII	0.42	IX
9.	Unawareness on market functioning among marketing functionaries including traders/ consumers	0.6	IV	0.5	VII
10.	Lack of Governmental support	0.43	X	0.35	X
11.	Inappropriate market Locations	0.58	V	0.71	III
12.	Others	0.33	XII	0.29	XII

4 Conclusion

Fish has become an important item of trade in domestic and international sector. Fish production highly depends on the growth and development of demand driven markets both in domestic and export sector. Though India has a large population of vegetarians, fish consumption is very common among a large section of non-vegetarians, particularly in rural areas⁽²¹⁾. Thus, increase in demand for fish enhances the fishing intensity and excessive demands for certain varieties leads to targeted fishing. From the study, it was found that of the total species traded across different markets of Andhra Pradesh and Telengana, inland species (i.e; Catla, Rohu, Tilapia, *Pangasius*) are the most available and traded fishes compared to other fishes traded/available across the markets. The reason can be explained because of its high demand and quality taste. Thus fish demand was sensitive to the price changes, the inland fishes were the highly preferred fish species among consumers of Andhra Pradesh and Telengana and its demand seemed to be low-responsive to price changes, keeping the income constant.

Even though Andhra Pradesh and Telengana have strong marine aquaculture base, the capture and culture of inland fishes are significantly higher as compared to marine catches⁽²²⁾. The diversity analysis shows a very impressive species- market diversity bound across the different markets of Andhra Pradesh than Telengana. Catla and Rohu stands as the most diversified species among the different species, which shows the higher demand — supply paradigms of these species across the markets of Andhra Pradesh as well as Telengana⁽²³⁾.

The high transportation costs, poor communication facilities, terrible drainage system, insufficient supply of ice, poor water supply, low hygienic condition, sanitary facilities, capital, demand of labours, storage facilities, marketing facilities, market information adversely affect the trading/ marketing of fish across Telengana and Andhra Pradesh. When the traders manifest with these large number of constraints, the fish get damaged and the traders are forced to sell at a very cheap price which necessitates the need for developing appropriate measures to overcome the concerns of fluctuating price, demand-supply paradigm shifts, production, distribution and consumption constraints. Moreover, development of a Fish Market Price Information system could act as a support system for ensuring the fish price movements across the state and could provide virtual price, fish accessibility, affordability and availability of fish for the people enabling domestic fish marketing policies for future.

References

- 1) Béné C, Arthur R, Norbury H, Allison EH, Beveridge M, Bush S, et al. Contribution of Fisheries and Aquaculture to Food Security and Poverty Reduction: Assessing the Current Evidence. *World Development*. 2016;79:177–196. Available from: <https://dx.doi.org/10.1016/j.worlddev.2015.11.007>.
- 2) Kumar P, Khar S, Dwivedi S, Sharma SK, Himabindu. An Overview of Fisheries and Aquaculture in India. *Agro-Economist*. 2015;2(2):1–6. Available from: <https://dx.doi.org/10.5958/2394-8159.2015.00011.0>.
- 3) Murugan K, & Sivagnanam KJ. Fisheries sector and Economic Growth in India. *Journal of Economic & Social Development*. 2018;14(2):83–99.
- 4) Ayyappan S, Krishnan M. Fisheries sector in India: Dimensions of development. *Indian Journal of Agricultural Economics*. 2004;59(3):392–412.
- 5) Sreevyshnavi PV, Venkatarao PP. Importance of marine fisheries in Indian economy. *International Journal of Applied Science Engineering and Management*. 2016;2(10):68–83.
- 6) Shyam SS. Demand and supply paradigms for fish food security in India. *Seafood Export Journal*. 2013;43(5):34–40.
- 7) Lauria V, Das I, Hazra S, Cazarro I, Arto I, Kay S, et al. Importance of fisheries for food security across three climate change vulnerable deltas. *Science of the Total Environment*. 2018;640:1566–1577.
- 8) Sathiadhas R, Narayanakumar R, Aswathy N. Marine fish marketing in India. *CMFRI Kochi*. 2012.
- 9) Salim SS, Ramees RM, Safeena PK. Price stability of commercially traded fishes in Ernakulam Markets. *Indian Journal of Agricultural Marketing*. 2019;33(2):51–59. Available from: <http://eprints.cmfri.org.in/id/eprint/13987>.
- 10) Cmfri F. 2020. Available from: <http://eprints.cmfri.org.in/id/eprint/14325>.
- 11) Cmfri K. Marine Fisheries Census 2010 Part II. Andhra Pradesh. 2012. Available from: <http://eprints.cmfri.org.in/id/eprint/8999>.
- 12) Mugaonkar P, Kumar N, Shelar G, Biradar RS, Rao K. Delineation of Supply Chain of Pangasius in India: A Case of Andhra Pradesh. *Current World Environment*. 2016;11(3):907–915. Available from: <https://dx.doi.org/10.12944/cwe.11.3.26>.
- 13) Maheswarudu G, Rao GS, Rohit P, Laxmilatha P, Ghosh S, Muktha M. Marine fisheries of Andhra Pradesh: a decadal analysis. *Indian Journal of Fisheries*. 2013;60(3):27–33.
- 14) Kumar BG, Datta KK, Joshi PK, Katiha PK, Suresh R, Ravisankar T, et al. Domestic fish marketing in India-changing structure, conduct, performance and policies. *Agricultural Economics Research Review*. 2008;21:345–354.
- 15) Raju SS, Salim SS, Pattnaik P. Market structure analysis of fish markets in North coastal districts of Andhra Pradesh. *Marine Fisheries Information Service; Technical and Extension Series*. 2017;232:17–20. Available from: <http://eprints.cmfri.org.in/id/eprint/12645>.
- 16) Hossain MA, Asif AA, Zafar MA, Hossain MT, Alam MS, Islam MA. Marketing of fish and fishery products in Dinajpur and livelihoods of the fish retailers. *International Journal of Fisheries and Aquatic Studies*. 2015;3(1):86–92.
- 17) Das A, Upadhyay AD, Kumar N, Prakash S, Debnath B, Datta M. Marketing profile of selected fish markets of Tripura. *Agricultural Economics Research Review*. 2013;26:115–120.
- 18) Prasad S. Fish transportation and Marketing in Dumraon and Buxar, South Bihar. *Journal of Entomology and Zoology Studies*. 2020;8(4):1634–1638.
- 19) Kotni VV. A study on value chain management practices of fresh fish: An empirical study of coastal Andhra Pradesh. *Marine Fisheries. IOSR Journal of Business and Management*. 2014;p. 80–90.
- 20) Basu S, Khasim DI, Gupta SS, Rao CC. Quality of dry fish from markets in Andhra Pradesh. *Fishery Technology*. 1989;26:114–118. Available from: <http://aquaticcommons.org/id/eprint/18841>.
- 21) Agrawal S, Millett CJ, Dhillion PK, Subramanian SV, Ebrahim S. Type of vegetarian diet, obesity and diabetes in adult Indian population. *Nutrition Journal*. 2014;13(1):13–89. Available from: <https://dx.doi.org/10.1186/1475-2891-13-89>.
- 22) Kumar P, Dey MM, Paraguas FJ. Demand for Fish by Species in India: Three-stage Budgeting Framework. *Agricultural Economics Research Review*. 2005;18:167–186. Available from: https://www.researchgate.net/publication/227365256_Demand_for_Fish_by_Species_in_India_Three-stage_Budgeting_Framework.
- 23) Bharti V, Mini KG, Sathianandan TV, Pugazhendi D, Manjeesh R, Augustine SK. Marine fish landings in Andhra Pradesh during 2016-An overview. *Marine Fisheries Information Service; Technical and Extension Series*. 2017;233:19–20. Available from: <http://eprints.cmfri.org.in/id/eprint/12887>.